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ON HYDROPHOBIA

BY

DR. MC NEILL

ON
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A TREATISE

ON

HYDROPHOBIA

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BY

J. P. McNEILL, M.D. T.C.D., *Etc.*

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HYDROPHOBIA.

The old Greek term hydrophobia as applied to canine rabies is a misnomer, or at best only applies to the disease in man, for in the lower animals dread of water is not a constant or even a usual symptom; in fact, rabid dogs usually lap water with avidity, though the constriction in the pharyngeal muscles renders them unable to actually swallow it.

It is evident that this inaccuracy in nomenclature might be productive of dangerous mistakes, as leading to the supposition that in the lower animals willingness to approach water affords a proof of freedom from the disease, than which nothing can be further from the truth; but the disease has become so firmly associated with, and so well known by, its old name, that confusion is best avoided by merely associating that with the more modern and proper one of rabies, recollecting that in man terror of water is the most constant and characteristic, as well as frequently the earliest symptom, and that rabies in its literal signification of madness is usually absent, for the brain, except for occasional hallucinations, remains comparatively clear to the last.

Nor, on the other hand, is rabies an accurate term for the disease in the inferior animals, for in the various forms of "dumb madness" there is frequently little or no furious excitement, at any rate in the early stages, and the subject may continue gently and affectionately dealing death around it by its caresses till near the end.

In view of this dilemma, it is therefore useless to multiply or alter names, true safety to society, and the means of effective prevention lying mainly in a wider diffusion of information concerning, and a more accurate knowledge of, the premonitory symptoms of this horrible disease among the masses.

In adhering to the old Grecian nomenclature, or rather in combining that with the Roman, somewhat indiscriminately, I am therefore guided by the consideration of the incorrectness of either, as applied to the disease occurring in the higher and lower organizations, as well as by the fear lest their separation should suggest the idea of two different affections.

Hydrophobia is a disease of great antiquity, and has been mentioned by the earliest medical writers. Hippocrates, in his "Historia Animalium," describes it as an affection in which the patients are unable to drink, are terror-stricken and anxious, tremble at noises, and are seized with convulsions. He recommends the box-tree as a medicine.

Celius also wrote upon it, and advised cauterization, dry-cupping and suction; bathing or plunging the patient for long periods in the sea is also an ancient practice, and sometimes it is said has been followed by recovery. Van Helmont mentions the case of an old man who was treated by repeated and prolonged immersion, with the result that after he had been resuscitated his illness was found to have left him.

A well-known old fable spoken of by Pliny ascribes the disease in the dog to the presence under the tongue of a small worm called by the Greeks "Lyssa." The removal of this with certain ceremonials from a puppy was believed to free it from all danger of rabies, and the ridiculous operation seems to have been not unfrequently practised. The idea of the presence of a worm in that situation was of course derived from the resemblance of the frænum linguæ when in folds to a worm coiled up.

Another early writer considers the causation of rabies derivable from the malign influence exercised under certain conditions by the star Sirius, and advises a cock's comb pounded to be eaten as a remedy; and Pliny remarks that a person who has been bitten by a mad dog may preserve himself from rabies by reducing the head of the dog to ashes, and applying it to the wound. These ashes also taken in water as a drink he believes to be very efficacious. As a rule our forefathers had a partiality for remedies of a somewhat revolting character.

As to the geographical distribution of the disease, it is not limited to any particular region, but it is much more prevalent in the temperate than in the frigid or torrid zones.

Dr. Kane, nevertheless, in an exploratory expedition in high northern latitudes, was obliged to destroy a number of his sledge dogs on account of their exhibiting symptoms which led him to believe they suffered from rabies; and Sir Samuel Baker in an account of his exploration of the Nile tributaries tells us that the disease is known and feared in Abyssinia and Africa. It is also familiar to Russians, Swedes, Danes, Norwegians, Laplanders, Chinese, and Indians. In fact it is more or less universal.

The fact is noticeable that animals in their natural state—or in a condition approaching to it—are considerably less liable to rabies than those leading what may be termed an artificial life—for instance, while among domesticated dogs the disease is rife, those packs of lean and miserable mongrels which infest the streets of Eastern towns have seldom or never been known to originate an outbreak of rabies, though one would think their condition most suited for its reception, and as a matter of fact they are the subjects of most other ailments to which canine flesh is heir.

Animals, especially dogs, when it occurs in one of their own species, seem to possess an instinctive knowledge of the terrible nature of the disease. A rabid dog becomes an object of terror and aversion to his companions. They shrink away and fly rather than fight. Fleming, an eminent veterinary authority, records some interesting examples of this, where dogs of undoubted courage have shown the greatest terror towards, and reluctance to engage, another of their kind affected with rabies.

Among the brutes, those whose cutaneous function is least active seem most obnoxious to the disease, *ex. gr.* The dog perspires very little.

It may be noticed that in certain parts of the Continent—notably the Rhenish and Belgian provinces—a superstition has long prevailed that rabies should be treated by a priest and not by a doctor, and that a dog-bite cauterized by the heated latch-key (preserved for the purpose) of a certain St. Hubertus can never prove fatal.

Hydrophobia, or rabies canina, from its stealthy and insidious approach, the uncontrollable violence of its symptoms when they do evolve, and its awful ending—cannot but be regarded as one of the most terrible of diseases. It ranks with glanders and farcy as ascending from the lower animals to man, and tending to death; but enters another category in the terror which its name inspires.

Its present increasing prevalence, its horrible nature, treacherously mysterious incubation, and common cause, render all subjects connected with its etiology and treatment matters of grave and urgent interest.

In the system of disease a general compensatory principle seems to exist, providing that those affections which when developed are least amenable to treatment are most readily avoidable by prevention.

The operation of this principle we observe, for example, in paludal malaria, snake-bite, &c., diseases in which the specific cause which gives origin to each, may readily and surely be avoided; but once in operative contact with the system, effect follows cause with irresistible certainty.

Treatment may deflect and modify manifestations, but progress can with difficulty be arrested till the destined course be completed.

Of this primal principle rabies affords a striking example. Whether it be, as our forefathers considered, altogether incurable, and (on account of its supposed spontaneity) but incompletely preventible, or as later and more enlightened science would seem to assert, sometimes curable, and invariably preventible, it is incontestably true that to a very great extent, if not absolutely, the preventive means lie in our own hands, while—the disease once developed—remedies, as yet, usually fail.

Deductions from the experience of ages, illuminated by modern science, unhesitatingly assert that theoretically rabies is completely preventible, and not unexceptionally incurable. Unfortunately, however, theory and practice in this instance as of old are still at variance, although evidences are not wanting that the next era in medical science may be characterized by a more favourable prognosis. Daily we find drugs more capable of influencing its manifestations and duration, while surgery is but beginning to come to our aid.

That hydrophobia could be made entirely to disappear without the total banishment from our society of the species of animals from which man is usually inoculated—the canine and feline—may be considered at least improbable, for even if the disease never originates spontaneously in the lower animals (a point which is at present an open question) no man could demonstrate for certain the period at which protracted incubation from previous inoculation must cease, and absolute immunity be secured.

A universal quarantine, therefore, even if more practicable than a modern Arcadia, would bear within it, although indefinitely prolonged, the elements of failure: for each animal might return to society still carrying the dormant morbid principle from a previous inoculation latent in its system, ready to exchange a local for a generalized condition in response to any special stimulus.

Since, therefore, to completely crush out hydrophobia so long as the race of dogs and cats endure must be a moral, if not a physical, impossibility, our efforts must be directed to the restriction of the disease in a more indirect and secondary manner, by adopting to their fullest extent all the preventive measures at our command; and endeavouring to formulate a rational and consistent system of curative treatment for the symptoms when generalized.

Considering the rapid increase of the disease of late years, the question of what means to adopt for its diminution assumes a grave importance to the community. The problem may be solved in either or both of two ways: 1. *Decrease the infective sources* by lessening the numbers of the animals among which the virus takes origin; 2. *Or combat the disease more effectively* by preventive and curative measures.

Something remains to be done by each of these methods. *With regard to the former,* few will deny that the number of domestic animals of the species specially obnoxious to the disease is considerably in excess of what either the profit or pleasure of the community demands. Any appeal "to the common sense of most" being obviously futile—in legislative enactments lies the only remedy, and for this various suggestions are discussed further on.

Insomuch as the vast majority of cases arise from dog-bites, and comparatively few originate from any other cause, it is practically useless to take into consideration the condition of any other species. Attention may therefore be exclusively confined to canines among the inferior creation as factors of the disease. An increased dog taxation, a rigid enforcement of the laws concerning them, with some additional restrictive clauses and an extension of the metropolitan rules to the provinces, would tend to improve the situation, and lessen the mortality from rabies; an improvement in the breed of dogs, with a decrease in the number of mongrels might also be anticipated, and this would be a decided advantage —for, apart from sporting considerations, it has been noticed that curs of low degree have been disproportionately instrumental in disseminating rabies.

Really useful or valuable dogs comparatively seldom spread disease; they are too well isolated, controlled, and cared for; the real transmitters are either ill-cared-for mongrels, which lead a more or less vagrant life in search of food and amusement; or family domestic pets which, not being under strict restraint, have opportunities of communication with the last-mentioned class, and exchange diseases with them.

A reduction in the number of dogs throughout the country would assuredly be followed by a proportionate decrease in the number of cases of hydrophobia. To attain this end would be worth a considerable sentimental sacrifice; and it does not admit of a doubt that a vast number of dogs at present exist in the United Kingdom whose obliteration would cause very slight inconvenience or distress to any one.

Another important factor in the spread of hydrophobia is the extreme ignorance which prevails as to the nature of its early symptoms. The popular impression seems to be that rabid animals must necessarily be in a condition of furious excitement, and invariably express horror of water, than which, as is shown further on, nothing can be more incorrect.

This ignorance prevents the timely discovery of the ailment and the isolation or destruction of the animal before harm has been done. As an instance, I believe I am correct in saying, that not one-fourth of rabid animals brought under the notice ot veterinary surgeons are known, or even suspected by their owners to be in that or any other dangerous condition; sometimes they are supposed to be suffering from indistinct symptoms of poisoning or indigestion, sometimes from a bone in the throat.

This ignorance is not confined to the uneducated classes, but is widely spread; it is, therefore, of serious importance that more accurate information and knowledge of the initiatory phenomena of rabies should be widely diffused, and the public mind familiarized with its early symptoms.

This dissemination of knowledge would act in a double manner; not only would it fulfil its primary object, in causing early detection of the disease, but the familiar consciousness of the possibility of a deadly peril lurking in the caresses of a useless household pet, might be expected somewhat to alienate the affections of those individuals whose hearths might be endangered; and would thus act in a secondary manner towards a diminution in the numbers of those useless mongrels whose lives are an annoyance to all—but their soft-hearted owners.

As elsewhere mentioned, no dog which has bitten any person should be destroyed for a week after the deed, as should it be alive and well at the expiration of that period, no apprehension of hydrophobia in the future need exist in the mind of the bitten individual; whereas, should the animal unfortunately die, or be killed, during that time, a cloud of anxiety (the greater for being suppressed as it usually is) may overhang the person for years: as occasionally happens also, a train of nervous symptoms, simulating rabies, and causing great distress or even mania, may be induced by mental fears, acting upon a hyper-sensitive organization.

An idea prevails in some places that, should a dog, although healthy at the time of inflicting a bite subsequently become rabid, the bitten individual is in danger of following suit, and that therefore it is safer to kill the animal at once. This is, of course, without foundation in fact, though the subject may be attacked by false hydrophobia, from hysterical fear or imagination.

As suggested elsewhere, admonitory placards descriptive of the symptoms and prodromata of rabies in dogs, exposed at Police Stations throughout the United Kingdom, would, if merely by directing the attention of the masses to the subject, in all probability save a few lives annually, and be inexpensive.

The disease is still happily rare, but it is upon the increase, and the chances are that very few households in the United Kingdom have not at some period been within the reach of danger from it, whether they were conscious of the fact or no.

As regards the alternative division of the problem, the prophylaxis and treatment of hydrophobia, much still remains to be desired and done. The curative treatment of hydrophobia is still a dark subject, but we are not without warrant for hoping that it will eventually be controllable. Certain drugs undoubtedly exert an influence over the duration and manifestations of the disease; and their action encourages us to hope that we only require to discover means of supporting vital force, while we moderate the intensity of the symptoms until the specific nerve-fever runs its course, to effect a cure.

One case lately was prolonged for ten days, and another for seven, the natural duration being three or four, and occasionally we hear of a successful case; so therefore hope is certainly admissible.

Thorough destruction of the tissues affected—at the time of the bite—by efficient cauterization, free excision, or both combined (the cautery following the knife), affords the only reliable preventive safeguard; and the comprehensive severity of the operation must be proportionate to the interval between inception and treatment.

Although the conviction gains ground that the virus frequently remains local for an indefinite time, latent in the matrix of the wound; the inference is warranted by results, that the tendency is for adjacent tissues to become gradually infiltrated to a greater or less extent by the poison; and, therefore, if promptly upon reception of the wound, local circulation have *not* been arrested by compression, and cauterization performed, safety cannot afterwards be purchased at a less expense than that of comprehensive destruction or removal of the whole affected surface, and immediately contiguous structures. For this purpose either the knife or a searching escharotic is required. Such a mild agent as nitrate of silver would be absolutely inoperative.

To misconception upon this point many failures of cauterization as a prophylactic may be ascribed—nitrate of silver has a merely superficial action. Nothing weaker than nitric acid, or the actual cautery freely applied, is sufficient for delayed cases. The tissues should be affected either by the agent directly, or by subsequent inflammatory action, to a considerable depth, a slough formed, and carbolic acid employed in the after-treatment.

These remarks apply, of course, only to cases of secondary or delayed local treatment. If used promptly, any caustic applied freely to every part where contact with the diseased secretions has occurred, will suffice for safety.

Mr. Wyatt was bitten four times by dogs, undoubtedly rabid, but by prompt cauterization completely escaped the disease.

Evidence is in favour of the efficacy of local treatment, although applied long after the bite; and even should symptoms have appeared, if a preliminary aura in the limb have been felt, directing attention to the wound, excision and cauterization should certainly still commence the treatment.

PATHOLOGY.

Rabies is pathologically a disease induced by a specific poison introduced by inoculation into the blood and carried through that medium to the nervous centres, having a special affinity for the centres of respiration and deglutition, and tending to run a definite self-exhausting course after an uncertain period of incubation.

There are no characteristic pathological appearances evident to the naked eye, and the information furnished by the microscope, though it serves to localize the lesion, is extremely meagre.

An unusual fluidity of the blood is frequently observed, causing, by its gravitation to dependent parts, peculiarly well-marked discoloration. Decomposition is rapid. This want of coagulation is also observed after death by lightning-stroke or snake-bite, and has suggested an analogy between the diseases which further investigation has failed to support. They also resemble each other, in that cadaveric rigidity is not well-marked in any of the three. In the brain, the only lesions discernible are confined chiefly to the medulla and fourth ventricle, and consist of an aggregation of leucocytes around the blood-vessels of the central nervous system, with exudations surrounding the vessels of the spinal cord, medulla oblongata, pons Varolii, corpora quadrigemina, and corpus striatum, especially the two first.

Some degree of swelling and granular degeneration has also been noticed in the nerve-cells by Dr. Gowers: these changes, though slight, being most apparent in proximity to the hypoglossal, pneumogastric, and pharyngeal nuclei, and attaining their maximum of intensity in the respiratory central region of the medulla.

These lesions are very similar to those described by Benedikt in the dog, and by Coats in the lower nerve-centres in man. In two cases Dr. Gowers found clots evidently ante-mortem, and having the appearance of emboli in many of the larger vessels, and one specimen presented thickening of the inner coat of a vein opposite the older part of a clot, with a corresponding reduction in the size of the clot, thus affording a presumption that the formation of the clot was subsequent to, and dependent upon, the alteration in the inner venous coat.

To Dr. Joseph Coats belongs, I believe, the credit of having pointed out the identity which exists in the locality of the pathological lesions in rabies, and in tetanus, as well as a certain similarity in the nature of the changes found. In the case of tetanus, he describes the exudation as a granular material, and in rabies as an aggregation of leucocytes around the blood-vessels of the central nervous system; in both cases the parts affected being the upper part of the spinal cord, and medulla oblongata, the pons Varolii, and corpora quadrigemina.

The salivary glands in rabies he also found infiltrated with leucocytes, which had special relations with the blood-vessels; and another observer found crystalline bodies in the salivary glands of a hydrophobic patient, which he had never noticed in that situation before.

There is nothing characteristic in the evolution of leucocytes, as these bodies have been observed as a result of several inflammatory states of the brain, involving a high degree of arterial tension, and are probably merely its result. Nor is the discovery of exudation or exudative infiltration peculiar to the disease, but pathological research has established the locality of the lesion, and thus done service.

Dr. Coats concludes, in his paper on the subject, that in tetanus and hydrophobia there seem to be two different poisons, each of which, circulating in the blood, attacks the nervous system and causes irritation, but as they are different in nature, so the kind of irritation they produce is different. There is, however, a remarkable similarity in the parts affected.

In some cases the nerves in the neighbourhood of the wound have been observed to be reddened and inflamed, but with the exception of congestive appearances in the central parts mentioned, the post-mortem evidences of rabies are chiefly negative.

Lockhart-Clark and others have described a certain softening and disintegration of the grey matter in the spinal cord, in tetanus. His explanation of the spasms of tetanus is, that they depend upon the conjoint operation of two separate causes: first, upon an abnormally excitable state of the grey nerve-tissue of the cord, induced by the hyperæmic state of its blood-vessels, with the exudations and disintegrations resulting therefrom; secondly, that the spasms depend upon persistent irritation of the peripheral nerves, by which the exalted excitability of the spinal cord is aroused. (*Bryant.*)

Dr. Benedikt, of Vienna, from examination of dogs, concludes that in rabies an exudative inflammatory process takes place, accompanied by hyaloid degeneration, owing to exudative infiltration of central connective tissue. (*Wiener Med. Presse.*)

Dr. Coats, in pathologically contrasting rabies with tetanus, considers them both primarily vascular, rather than nervous lesions, and mentions the analogy which exists between the former and tubercle, both as regards indefinite period of latency and sudden generalization of lesions, local sometimes for years.

The varied symptoms of the disease he explains by generalized nature of the lesion. The mania from implication of the cortex, hyperæsthesia and spasm from affection of central parts, and heightened reflex action over the surface from engagement of peripheral vessels.

Very similar conditions of the medulla and cord are found after poisoning by strychnine—*i.e.*, evidences of congestive exudation.

The resemblance of rabies to tubercle is very slight, and merely accidental. Like that disease, after an uncertain period of latency or localization, it suddenly generalizes itself, with elevation of temperature and a tendency to death; but there the similarity ceases, for tuberculosis destroys life by disintegration of natural tissue, and its replacement by a new material mechanically incapable of sustaining vital functions, and demonstrable after death; while rabies kills merely by violence of temporary functional derangement, without any apparent organic disorganization sufficient to be incompatible with life.

It is not a nerve inflammation, for inflammations do not destroy life without leaving traces. It can only then be defined as—

A specific nerve-fever, having an indefinite period of latency or incubation, but, when generalized or developed, tending to run a definite and auto-exhaustive course, of a few days' duration; produced by the entrance into the circulation of a specific animal poison, which has a peculiar affinity for the respiratory nerve-central tract, and tending to destroy life by exhaustion of vital force, consequent upon excessive nerve stimulation.

The analogy of tetanus to rabies is more extended. Both are usually immediately preceded by inflammatory alterations in the nerve substance at the seat of the wound, accompanied by painful premonitory local symptoms; in both the morbific influence is attracted to the same centre; except that that of rabies evinces a predeliction not shared by its fellow for the respiratory, rather than the spinal nuclei, and both produce their effect by a process of irritative nerve stimulation.

That their manifestations differ in detail as regards the precise extent, nature, and appearance of the paroxysms is an evidence that the autogenetic poison of tetanus possesses differences both in degree and in kind from rabid virus: but the parallelism of the general course of the two diseases, the comparative identity of the changes produced in the central tissue, and the fact of the like relieving influence exercised by the same medicines in both—together with the similarity in mode by which they destroy life—tend to support the assumption that etiologically the diseases are closely allied.

The long and irregular period of incubation is one of the most extraordinary points connected with rabies, and the most difficult to explain. Whether, in the majority of cases, the virus at once leaves the wound and permeates the system, or remains imbedded in the matrix of the wound till some peculiar change in the constitution takes place to suit the system for its reception and favour its generalization, is a question which has been much discussed, but the balance of authority and evidence is in favour of the latter supposition.

It would be the strangest anomaly known to medicine, for a poison to permeate the system for such a long and indefinite time before producing its effects.

Dr. Todd Thompson considers that since the virus is not governed by the usual regular laws of incubation common to morbid poisons it remains in the bitten part, till aroused by some predisposing change in the constitution to pervade the system and produce symptoms; and Professor Rust describes a case where thirty-one days after the bite, and when symptoms had already appeared, excision was performed and the patient recovered, affording thus a presumption that some of the virus still remained in the wound and its removal lessened the force of the disease.

By no other theory can we account for the splendid results obtained by cauterization and excision, even when performed after some time has elapsed since inoculation, than by supposing that the venom frequently remains stagnant in the wound, and only generalizes when evoked by some special cause. (Vide *Cauterization.*) Sir Thos. Watson and Sir W. Gull also favour these views.

Hertwig says the virus loses its potency twenty-four hours after death, or as soon as rigor mortis sets in, and evidence favours the assumption that its virulency soon decreases. Eckel inoculated an animal with the blood of a man who had died of hydrophobia two days previously without producing the disease.

But, *per contra*, a pupil who cut his finger while examining the twenty-four hours' dead body of a rabid dog received the disease and died. Probably in the larger animals the virus would remain active for a longer time. The saliva is the usual medium of transmission, and seems even more densely charged with the poison than the blood. The salivation is probably an effort at elimination of disease, and this has pointed to the use of sialagogues.

SPONTANEOUS HYDROPHOBIA.

A CONDITION in which horror of, and inability to drink, water forms a prominent symptom, has occasionally been observed to occur during the course of acute diseases, as well as after injuries, or during disturbed mental states.

According to Shinkwin it has shown itself—

After great heat following excessive exercise,
„ an attack of epilepsy,
„ severe blows on the head,
„ drinking cold water during copious perspiration, as well as

During malignant and putrid fevers, peripneumonia, articular rheumatism, peritonitis, œsophagitis, melancholia, hysteria, and inflammation of stomach.

M. Poteau, M. Valleix, and Dr. Hirtz also mention similar cases; and Boerhaave had a case of a man who died—suffering from fever, a nervous train of symptoms, and horror of water—after having been, while intoxicated, exposed to the sun's rays with uncovered head.

Instances of supposed spontaneous rabies in the human were reported much more frequently formerly than since science has advanced, and in such cases the correctness of the diagnosis has seldom or never been demonstrated by actual transmission of the disease to another animal by inoculation, which would afford the only real proof.

Also considering that the old treatment for rabies included prompt suffocation between feather beds, extreme truthfulness or candour as to the reception of a bite from a rabid animal previous to symptoms was hardly to be expected from the patient.

Spontaneous hydrophobia or false rabies has been caused by—

1. Suppression of lochia (*Lancet*, vol i., 1868, *Dr. Story*).

2. Intense cold (*British and Foreign Medico-Chirurg. Review*, vol. i., 1861; also in *Medical Times and Gazette*, vol. i., 1868).

3. By irritation of pin in stomach (*Lancet*, vol. i., 1874).

4. By bites of dogs not mad. (Vide *Ranking's*

Abstracts, vols. ii. and iii., 1874; *Lancet*, vol. i., 1876; and *Medical Times*, vol. ii., 1876, by *Moritz*.)

5. And it has occurred spontaneously or without any cause (*Guillery*, *Medical Times*, vol. i., 1872, and vol. i., 1859).

Whether rabies is autogenetic and capable of spontaneous production was for long another vexed question, and has been supported in the affirmative by high and recent authorities.

Mr. Fleming, a veterinary authority, and the writer of a book on rabies (1872), asserts that in the lower animals at any rate it certainly does arise spontaneously, and places it in the same category as glanders, farcy, and strangles in the horse, typhus in pigs, and distemper in the dog—diseases which, he says (although usually transmitted from one animal to another) undoubtedly sometimes, under favourable circumstances, arise spontaneously.

Youatt, Blaine, Meynell, however, also well-known writers on diseases of the inferior animals, on the contrary, seem to consider that even in the dog the disease cannot arise without direct inoculation from a rabid animal.

Certainly, except upon the hypothesis that the virus may lie dormant for a very long time, which Fleming denies, it is difficult to account for the sudden outbreaks of the disease among dogs, after long periods of immunity, in places where inoculation would seem practically an impossibility.

Fleming notices that in dogs in Algiers, during 1834, there was only one case.

In 1847 an isolated case appeared at Blidah. It broke out for the first time, in 1860, at Oran, Arzew, and Mascara, and after an absence of sixteen years it reappeared in Algiers, killing five persons in four months.

The same authority argues that in the lower animals it cannot spread by inoculation alone, for it sometimes appears in a general or epizöotic form, spreading widely through countries in which mad dogs are seen every year only here and there. If inoculation only caused the diffusion of disease, surely, he says, it would always in these regions be more or less general.

Even allowing for extensive transmission of virus during the occasional epizöotics, and granting the longest known period for incubation, he cannot explain its course without admitting its spontaneity.

In this opinion Fleming is supported by Vernois, who admits spontaneity in dog and cat (*Etude sur la Prophy-*

laxe Administrative de la Rage), relating several instances which he considers unmistakable, and accounting for its appearance in certain regions upon that hypothesis.

Tardieu also (*Dictionnaire d'Hygiene Publique*) gives instances of rabies occurring in the cat without any known cause, except in one case, depriving the animal of her kittens; and Bouley does not deny the possibility of autogenesis.

Among the most probable provoking causes of spontaneous rabies in the lower animals, several observers mention forced abeyance of the sexual functions, attributing the disproportionate prevalence of the disease among domesticated dogs to the limited numbers of females, and consequent enforced abstinence among the males. Christians, as a rule, destroy most of the female puppies in each litter, while Turks, &c., retain the sexes in equal numbers; and, whether it be a consequence or no, the disease is less frequent among the latter races.

As an instance of this, M. Desjardins mentions that during his visit to that region he discovered that only one breed of dogs was kept on both sides of the Danube —the wolf or pariah dog (*Chien loup*); and that, while on the Turkish side rabies was unknown, upon the Christian bank some cases occurred every year. Further inquiry elicited the fact that the Turks permitted both sexes to live indiscriminately, but that the Christians killed a great number of females, preferring the males.

Isolated and unsupported statements, however, and conjecture cannot be accepted as powerful evidence; and all experimental efforts at artificially producing the disease have failed. Some of these unsuccessful experiments were of the most cruel character. Bourgelat is said to have confined six dogs together without food or drink, till they began to devour each other from starvation, and finally died; but no sign of rabies was produced. Dupuytren, Magendie, Breschet, and others performed similar experiments on a varied and ample scale, with the same unsuccessful result; so that, if rabies unfortunately be capable of spontaneous generation, we are still unable to discover its principle of causation.

We know, at any rate, from these experiments, that no amount of physical suffering or mental excitement will originate the disease; though it may be supposed that such states would predispose to the generalization of the poison if already localized in the system.

Cats and other animals have been reduced by tortures of various kinds to a state of maniacal fury, during which their bites have produced unpleasant results; but in no case has true rabies been shown to arise in this way. In man, at any rate, we may take it for an established fact that rabies never occurs except by either direct or indirect inoculation from some of the fluids of a rabid animal.

There is no instance on record of rabies having been communicated by simple contact of the virus with a healthy mucous membrane, such as the lips; and Sir W. Gull mentions suction of the wound as being "unattended with risk;" but neither, I believe, is any case mentioned where the poison has been transmitted from man to man, though it is rational to presume infection would ensue. So that for a healthy person to suck the wound of another inflicted by a rabid animal, or to allow contact of the saliva or other secretion with even the unbroken skin, cannot but be regarded as a bold experiment. In such a case prompt cauterization would at least be prudent.

The disease has been experimentally communicated from one dog to another by applying rags steeped in the saliva to a raw surface on the body of the other during the life of the rabid animal; but I am not aware of any accurate experiments having been made with a view to discover how long the poison remains active after the death of the subject, or what length of time the virus remains active after extraction from the body.

The point would be worth investigation; for if, as has been asserted, the active principle soon dies, instead of remaining active even when dry, like small-pox or vaccine, a great anxiety would be removed from those responsible for the purification of bedding, &c., used by a rabid patient; while, if the contrary should be conclusively proved, a false security would be avoided.

The theory has been advanced that the symptoms of rabies are produced, not by any specific poison, but, as in tetanus, by the nature of the wound, or by some spontaneous morbid changes in it. Bader, in 1792, pointed out the similarity between the two diseases, and doubted the existence of a specific hydrophobic poison; but, as Sir W. Gull remarks, this is disproved by the fact that men and animals, though they are liable to every sort of wound, never contract rabies except from inoculation from a rabid animal. And, in addition, the disease is reproducible by mere contact of the saliva or other secretions of the diseased animal with a broken surface in another, without wound.

Reich records a case of transmission by suckling, but the evidence does not seem very conclusive.

With regard to the DIAGNOSIS of hydrophobia, tetanus, although a disease presenting several analogies to it, is hardly likely to be mistaken for it; however, lest a momentary doubt should arise, and especially since at least one observer has recorded a case where both affections coexisted, a contrast of the symptoms may be admissible.

TETANUS.	HYDROPHOBIA.
Has no proper period of incubation; symptoms appear almost always within twenty-two days, unless the disease be idiopathic, which is very rare.	Incubation seldom more than six months, nor less than one.
Persistent rigidity of the muscles of the jaw, and sometimes of the greater part of the voluntary muscular system also, with occasional paroxysms of tonic spasms superadded, chiefly affecting the spine, and causing opisthotonos, pleurosthotonos, or emprosthotonos, risus sardonicus, from rigidity of jaws.	Complete intermissions of spasms, which affect respiratory rather than spinal muscles, and do not particularly affect the jaws; usually no opisthotonos, pleurosthotonos, emprosthotonos, nor risus sardonicus; no rigidity of jaws.

Tetanus.	Hydrophobia.
Intellect calm.	Preoccupation, terror, or hallucinations.
	Intense hyperæsthesia.
No dread of water.	General respiratory spasm, produced by light, sound of, or effort to swallow, water, or by any sudden external contact with the senses.

In both diseases the temperature rises irregularly, there is salivation, and great nerve excitability.

From STRYCHNINE POISONING the immediate diagnosis is more difficult occasionally; but in this, the sudden or rapid occurrence of tetanoid convulsions, chiefly affecting the muscles of the trunk and spine, causing violent opisthotonos, and accompanied by pain, will generally distinguish it from rabies. The muscles of the extremities become rigid, the hands semiflexed, and the feet turned inwards. The paroxysms are very frequent, and are usually preceded by a cry of pain. There is no abhorrence of water, and between the paroxysms it can be swallowed, though the gulping and snapping manner of doing so, caused by the nervous irritation, bears a strong resemblance to the manner of a hydrophobic patient, and may thus deceive. Emesis and pain referred to the stomach are usually present. A large dose of strychnia is generally fatal in an hour or two, so a prompt decision is necessary.

From Snake-Bite.—Between the symptoms of rabies and those produced by the bites of venomous snakes there is little or no similarity. In the latter the symptoms come on at once or within an hour, are characterized by prostration and depression instead of nerve excitement, and are alleviated only by the most powerful and rapid diffusible stimulants—for example, spirits in large quantities or strong solution of ammonia administered subcutaneously. Extreme diaphoresis and enforced violent exercise afford the best chance of recovery, and the case terminates for good or evil in a few hours.

In rabies the extreme opposite holds throughout the course of the disease; in fact, the manifestations are violently contrasted. The only points of similarity are that after death abnormal fluidity of blood is observed in both, as it is also after death by lightning-stroke; and that, in the last stages of rabies, where prostration begins to follow excitement, and the diaphragm is threatened with paralysis, the same treatment—viz., ammonia—might be indicated, or eau de luce.

In snake-poisoning the symptoms are paralytic from the first. Serpent venom, too, does not possess that mysterious power of latency which is so dread an attribute of rabies. Indeed, though they agree in running a definite self-exhaustive course, and are conquered if the tendency to death be obviated for a certain limited time, yet their parallel description is rather a series of contrasts than a comparison. The chemical constituents of the morbific element in each case is, of course, beyond our ken; but in snake venom it is something which kills by retarding the proper decarbonisation of the blood by causing muscular failure of the respiratory and circulatory mechanism.

Drowsiness, coma, and muscular paralysis are prominent symptoms after the bite of the cobra; and the general appearances somewhat resemble those seen in opium-poisoning.

Reasoning from a supposed analogy between snake-poisoning and rabies, violent exercise and copious perspiration have been recommended in the latter. This formed the basis of practice of an Irish blacksmith who enjoyed the reputation of being able to cure the disease. In one case his advice was: "You must start off directly, and walk twenty miles as fast as you can. Meanwhile I will make up some medicine, which you must call for in the evening." This, however, was only in a case where a man had been licked by a mad spaniel, and feared he might have been inoculated.

Captain Maxwell, the author of "Wild Sports in the West," mentions the ancient custom of suffocating a rabid patient between feather beds, as being prevalent at that time in the West of Ireland; and relates an instance of a man who, after having suffered this treatment, and having been left for dead, astonished his executioners by crawling from the bed cured of his disease. The bed was found to be saturated with the perspiration of the unfortunate man, exuded during the agonies of asphyxia; and it was presumed that this copious diaphoresis, combined with the nervous shock, had been sufficient to eliminate the virus.

MENTAL OR HYSTERICAL HYDROPHOBIA.

IN the *Dictionnaire des Sciences Médicale* several instances are given of the apparently spontaneous production of rabies by the bites of persons or animals suffering from furious excitement; and certainly a condition in which a terror of and inability to swallow water was evinced, coupled with a train of symptoms evidencing intense nervous excitement, has occasionally followed such injuries; but these cases do not usually terminate in death, and may generally be distinguished from the true disease by the absence of proper chronicity and proportion in the symptoms, and by their occurring immediately or soon after the injury, without the thirty or forty days' interval which is the shortest incubation usual in rabies.

Dr. Shinkwin, of Cork, in his Lectures on Rabies, says he is obliged to come to the conclusion that the bites of non-rabid animals, even though they may not have been ill previous to or after the infliction of the injury, can in some rare cases, and under circumstances which lead to excite their anger, produce true hydrophobia; but the lectures were delivered fifteen or twenty years ago, and all subsequent experimental efforts to produce the disease artificially have failed.

Collateral evidence also as to the disposition and habits of the patient will generally afford a clue to diagnosis, and mental hydrophobia is extremely rare.

Mania, in certain of its more acute and obscure varieties, is among the diseases most liable to be mistaken for rabies in its early stages.

A patient labouring under cerebral excitement, coupled with perhaps an illusion connected with hydrophobia, may involuntarily simulate many of the symptoms of the true disease from memory, and others from hyperæsthesia or hysteria; and when it is recollected that a decided and prompt opinion is important, and expected at the first interview, the difficulty and anxiety of diagnosis becomes obvious.

Close observation, however, will detect discrepancies in many particulars.

1. In mania, the temperature will probably be normal; or, if it be higher, evidences of brain mischief will be apparent, characteristic of the special lesion. In rabies,

though the thermometer is here but an imperfect guide, there is generally a rise, unaccounted for by cerebral conditions.

2. The dysphagia of hysteria or mania differs from the true hydrophobic spasm in affecting the pharyngeal muscles directly, and being limited to them; or taking the form of spasmodic contraction known as *globus hystericus*, instead of a violent and general convulsion of the whole respiratory apparatus, commenced and characterized by forcible inspiratory spasm, and only involving the pharynx in but a secondary degree.

In false hydrophobia the respiratory spasm is absent, or merely momentary and local. The convulsive element is but slightly marked. The alternations of lucid though anxious intervals with frenzied muscular convulsions, are not recurrent with the same regularity; nor, if present at all, can they be exaggerated or reproduced by the same exciting causes which influence them in true rabies.

In the real disease, also the gradual onset of the symptoms, the increase of cutaneous sensibility to intense nervous hyperæsthesia, unaccompanied by any localized central pain; the salivary changes, the general respiratory paroxysms, produced by any sudden communication with the special senses, or by contact with fluids; and the peculiar anxious preoccupation of manner while free from pain or spasm between the attacks, are seldom counterfeited with any degree of accuracy, some disproportion always existing.

In mania the cerebral excitement resembles other maniacal attacks, and does not implicate the voluntary muscles like that peculiar to rabies.

Chomel enumerates three kinds of pseudo-hydrophobia :—

1. Simple horror of liquids.
2. Symptomatic hydrophobia.
3. Rabiform hydrophobia, or spontaneous rabies.

Valleux recognises this division, and mentions several cases simulating true hydrophobia.

Dr. H. Finlay also narrates a case in the *Lancet,* where two months after having been bitten, a boy suddenly exhibited a train of hysteric symptoms, accompanied by a dread of water and of dogs, and complained of pain radiating from the healed wound. The case, however, never showed symptoms in proper proportion or sequence, nor did it deceive the medical attendants.

Termination — recovery after some weeks — under bromide of potassium, and hydrate of choral.

INCUBATION.

THE variable and uncertain period, during which the disease may lurk in the system without declaring itself, is its most mysterious and hideous characteristic. Evidence upon this point is extremely contradictory; according to Bryant, the extremes are from six weeks to a year.

Thamhayn, in an analysis of 220 cases, showed that in 49 the symptoms appeared within one month, in 98 during the second, in 29 during the third, and in 26 during the fourth month. Of the remaining 18, 16 developed within 26 months, the remaining two only maturing at a period of four and five and a half years respectively. To the two latter considerable doubt attaches.

Dr. Shinkwin, from a copious analysis of cases, reckons the shortest period of incubation at twelve, and the longest 334 days; while taking the average of 120 cases, he calculates the medium interval to be 61 days.

Among the lower animals, Fleming and Bowley assert that incubation varies from one to two months, and that after three the chances of immunity are great. About fifty per cent. of bitten lower animals take the disease.

Among modern authorities there seems increased hesitancy in fixing a limit as to the extreme length of possible incubation, but from Thamhayn's cases it will be seen that out of 220, 147 developed in two months, and 176 before the end of three. Some degree of doubt must surround the other cases, as the difference in time is so great.

SYMPTOMS IN THE DOG

As it is nearly always from the dog that man contracts hydrophobia, it becomes important to recognize the symptoms in that animal. The first noteworthy points are, that, as a rule, there is neither dread of water nor violent rage shown by any of the lower animals, during at least the early stages, and all through the disease they eagerly attempt to drink, though they are unable to swallow.

Horses and cows will plunge their muzzles deeply in the trough, and a dog lap rapidly, making eager efforts at deglutition, although none of the fluid really enters the stomach.

According to the experience of Mr. Duguid, V.S., dogs are rarely violent at first, and may even be unusually affectionate and docile. The symptoms are insidious, and may easily escape unskilled observation. Inoculation usually occurs under one of two different sets of circumstances—either when a rabid animal is at large or when he is caressed by his owner or others, who are unaware of the nature of his ailment. In any case, contact of the saliva with a broken surface on the skin is sufficient to produce the disease.

A peculiar change in the dog's manner is usually the first premonition—too trifling for a stranger's notice, but evident to those who are either skilled in disease or familiar with the animal.

He moves about restlessly in a sad, preoccupied, apprehensive manner, loses his natural sprightliness, ceases to take notice of passing objects, and withdraws into dark corners.

His appetite becomes altered and depraved; he refuses his natural food, and devours strange and filthy materials with greed. This is a rather constant and early symptom, and should always be regarded with suspicion, if occurring in a dog who exhibits any of the previously mentioned alterations in behaviour; but if, in addition, he shows strange irritability at the presence, sight, or sound of another dog, snapping fretfully at him without provocation, and contrary to his usual habit, instant precautions should be taken.

Symptoms then begin to refer to the mouth and throat; the dog seems uneasy, frequently licking the corners of his mouth, and scratching them with his paws to remove the sticky mucus which collects; yawning, and acting generally, much as if he had a bone in his throat, except that in that condition he would keep his mouth open, coughing violently, moaning or howling, and making efforts to dislodge the foreign body.

A bone in the throat has often been mistaken for rabies, and *vice versâ*; so, when in doubt, it would be advisable to promptly obtain a skilled opinion, meanwhile securing the dog. If water be offered to a rabid dog at this stage, he will probably lap it up greedily, but close inspection will show that very little, if any, of the fluid is actually swallowed, the dog only biting and licking the water in his ineffectual efforts to satisfy his thirst.

The natural tone of voice is changed to a hoarse and peculiar howl, not unlike that of the wolf, expressive of pain, and easily recognised by an expert. The manner, previously moody and preoccupied, becomes nervous and apprehensive; he lies with half-closed eyes, careless of external objects, yet not at rest; suddenly starting up, he snaps at an imaginary object, watches nervously and angrily an invisible fly—listens anxiously for a moment, and moodily sinks again to a fretful doze. The period of hallucinations has begun.

If at large, the gait of a mad dog is characteristic. Other dogs take an interest in every passing object, and are alive to every sound or movement; he alone passes moodily along with lowered head, and usually an awkwardness in movement of the hind legs, caused by loss of power; preoccupied by his own sensations, he moves gloomily on as if with a settled purpose—snapping angrily at any of his species who molest him, but as a rule avoiding men and animals—seeking solitude and darkness.

If interfered with he may be roused to sudden frenzy, and attack all animals indiscriminately. As the disease progresses the limbs may be partially paralyzed, the discharge from the mouth increases, the lower jaw hangs as if powerless, swallowing becomes difficult, and the saliva pours from the mouth. Paroxysms of furious excitement may ensue, during which the animal fiercely attacks whatever is near, even biting at sticks or stones, and is roused to frenzy by the sight of one of his own species. If not destroyed, he will finally slink away to die in solitude and darkness.

It is especially noticeable that the dog usually recognizes his master with affection even late in the disease, and may fly to him anxiously for protection from his terrible sensations, licking his person, and lavishing his deadly endearments upon the members of his household, while biting savagely at others. Also, that in that form of the disease known as dumb madness, symptoms of excitement or fury may never appear, the animal continuing gentle and affectionate to the last; generally, however, the presence of another dog will excite a paroxysm of rage. Fear of or repugnance to water is not even a usual symptom in any of the lower animals.

If a dog suspected of being rabid should have bitten any one, he should on no account be destroyed till it become evident whether he really was suffering from the disease at the time or not. In order that the mind of the bitten person may be relieved from apprehension of hydrophobia, the dog should be secured and watched for a week; if he show no further signs of madness, it is a proof that he was and is harmless.

In only two out of fourteen cases observed in the Brown Institution (according to the *British Medical Journal*) during the year 1876, were the animals in the excited state supposed to be peculiar to rabies. In each instance the dog was brought by its owner, who in general had no idea of the serious nature of its ailment, but imagined it to be suffering from indigestion, or that it had swallowed a bone.

Unusual irritability of temper towards other dogs is a dangerous sign; if a dog, previously gentle in disposition, be observed to snap or bite at other dogs which it casually meets, it should be closely watched for a few days.

The general period of incubation in dogs is from three to twelve weeks—seldom more.

It is a popular error that rabies is more common among the lower animals during summer; as a fact, it is more rare during the "dog days" than in colder seasons. It need hardly be said that no treatment but prompt destruction is applicable to any of the lower animals, when once the diagnosis of rabies is established.

Whether the disease can be communicated by eating the flesh of an animal which has died from rabies is an undecided question. Mr. Fleming, V.S., I believe, is of opinion there is not much danger in doing so.

Whether the poison can be transmitted through the milk of an affected person or animal, is also still uncertain; but if it be transmissible, the virus would probably be weaker, and it would not be likely to lie latent for an uncertain time, as it would at once pervade the system.

DIAGNOSIS AND SYMPTOMS IN MAN.

In the diagnosis of rabies, the absence occasionally of all consciousness of having received a bite, together with the uncertain period of incubation possible, constitute a difficulty which the necessity of an early decision renders important to overcome. On the other hand, the too apprehensive nervousness of the patient, by leading him to jump to the conclusion that his symptoms are due to rabies, may hurry the physician to an opinion the inaccuracy of which a few days must disclose. A careful scrutiny of the exact nature of the symptoms complained of, however, especially as regards their chronicity and proportion to each other, will generally serve to distinguish the premonitory stages from nervous or mental affections, as the relation of physical to mental symptoms in rabies is extremely hard to simulate.

Symptoms.—Dr. Sanson summarizes the clinical features of rabies as consisting of—incubation, six or seven months (*on the average*); prodromata, three weeks; initial symptoms of pain, three days; convulsions, two days. And Mr. Erichsen groups the characteristic symptoms as—

1. Spasmodic affections of muscles of deglutition and respiration.
2. Extreme sensibility of surface and special organs.
3. Excessive mental terror and agitation.

Premonitory Symptoms.—After some days of sadness, anxiety, restlessness, and preoccupation of manner, during which the mind is filled with a sense of impending danger, a sudden sense of nervous shock at the presence of water, and a difficulty in swallowing fluid, usually announce the disease.

This difficulty is not caused by mechanical obstruction, but by a sudden spasm affecting the whole respiratory apparatus, causing "catching of the breath," and forcible inspiration, coupled with a feeling of nervous horror and aversion to the touch of water.

Frequently a fit of choking at the presence of water (or at hearing it trickle), which has been preceded by anguor and nervousness for a few days, first ushers in the malady, or inspiratory catching of the breath is first noticed; sometimes a sense of oppression in the chest, and epigastric pain is complained of.

The cicatrix of the wound sometimes inflames, and occasionally neüralgic pains, like epileptic aura, radiate from the spot.

Slight spasm of the diaphragm, and other signs of nerve irritation, are also frequent. Light and noise are disagreeable to the patient, and he is easily startled.

After these symptoms continue a few days, a distinct spasm produced by contact with fluid reveals the nature of the disease. This is inspiratory, involves the whole respiratory tract in particular, and the whole body to a less degree. It passes off completely in a few minutes, leaving the patient terror-stricken, bathed in perspiration and gasping for breath, but mentally unaffected and free from pain.

As the disease develops the temperature rises, pupils become dilated, and surface circulation increased, showing implication of sympathetic; retinal arteries largely dilated, respiration and pulse hurried and irregular.

The secretion of saliva is at first scanty and viscid, afterwards very copious and frothy, the patient constantly striving to expel it. Thirst is generally a prominent symptom, but the sufferer is unable to gratify it, even by swallowing saliva, the trickling of which down the throat produces spasm.

The urine in a case under the care of Dr. Sanson was alkaline and contained albumen, urea, sugar, blood, triple phosphate, urate of ammonia, and epithelial casts of tubercles.

Dr. Shinkwin found pain in the wound occur once in every four cases, redness and inflammation once in twelve ; cicatrices, quite healthy in one-third of all cases; shivering and sadness in two-thirds of all cases; severe thirst, a marked symptom in eight out of every twenty-one; premonitory stage entirely absent once in every four, hydrophobia being the first symptom noticed. In four out of every fifteen cases spasms in the muscles of the throat and face first alarmed the patient.

Nausea, or vomiting, occurred in three of every fifteen instances, while hurried respiration, oppressive dyspnœa, with suffocative attacks following the sight of fluids or attempts to swallow, and often occurring spontaneously, formed a symptom in two of every three.

A brilliant, wild, or haggard expression of the eyes presented itself seven times in every eighteen. General convulsions, alterations in sight or hearing, with hallucinations, were observed frequently about the same time.

Increased secretion of saliva begins about the time these phenomena develop, and pours from the mouth, or is repeatedly expectorated in five out of every six cases. Delirium occurs about the same time eight times in twelve, and soon assumes a more or less furious character, in the proportion of three to twelve cases.

The pupils become dilated five times in sixteen, contracted once in thirty; eyes injected once in twenty; imperfect vision once, and total loss of vision once in 120 cases. Alteration in the genital functions was a painful symptom once in every eight cases.

Asphyxia was produced by a convulsion nine times in thirty-seven cases, collapse terminated one in thirty, and coma one in forty cases.

In Dr. Shinkwin's cases, the shortest interval between bite and death was 14 days 18 hours; least number of hours from first symptom till death, 18 hours; greatest interval between first symptom and death, 201 hours; leaving average duration of symptoms, 70 hours 48 minutes.

Even if no preventive measures are adopted, inoculation is not invariably followed by infection. According to Niemeyer, of 145 persons bitten by rabid animals in Würtemburg only twenty-eight took the disease, or one in five. Herting made 100 inoculations on the lower animals, and only twenty-three were effective.

The bite of a rabid wolf is more likely to produce hydrophobia than that of a dog. Of 250 cases recorded by Renault of persons bitten by mad wolves, nearly two-thirds, or 164, contracted the disease (Jaccoud).

This was probably because wolves bite more savagely than dogs, and thus rendered inoculation more certain; also people bitten by wolves have not usually preventive means at hand.

It should be remembered that inoculation does not follow every bite, for sometimes the virus is brushed off by the clothes, or washed away by blood flowing from the wound.

TREATMENT.

Comparatively few drugs could be mentioned, which have not been ineffectually tried at some period during the course of the disease.

Certain medicines undoubtedly do possess an influence in modifying the manifestations of rabies, and may be called antagonistic remedies, but evidence is against the idea of the existence of any specific properly so called.

It is encouraging to note, however, that as our knowledge of the disease increases, we become more capable of moderating its symptoms, and increasing its duration, and I cannot but think that eventually rabies will be ranked among curable, as well as preventible, diseases.

An intelligent and consistent treatment of symptoms, with the object of merely obviating the tendency to death for a limited time, combined with a rigid economy of vital energy, and an urgent and sustained effort to introduce, and retain in the system, a sufficient supply of food to support the constitution through its week of trial, affords the best chance of success.

The initial difficulty is to reduce the early nerve excitement, without fatally increasing the subsequent inevitable prostration. This accomplished, the problem is solved, for the disease kills, not by any tissue degeneration or chemical change, but merely by the temporary violence of functional derangement, and the nerve prostration and paralysis consequent upon excessive irritant stimulation.

Cases of death from alcoholism or from tetanus present many similar features, although, of course, there are differences both in degree and kind in the manner in which nerve manifestations evolve.

In almost all notes of recorded cases, there is a conspicuous absence of information as to the precise quantity and quality of nourishment introduced and retained during the course of the disease. This I should venture to call a significant fact, when coupled with the description of the low typhoid state into which prolonged cases sink; and an admonition that urgent and sustained efforts at stimulative nourishment should be persisted in from the first commencement of symptoms.

The amount of assimilation of food sufficient to sustain vital functions for a week under ordinary circumstances, affords no criterion of the quantity required when violent paroxysms, during each of which a vastly increased percentage of vital force expenditure doubtless takes place, recur at brief intervals.

Also the arrest of assimilation, inevitable during the spasms, renders additional attention to the process in the placid intervals more important.

Evidence seems strongly to indicate that the most difficult as well as the most important problem in the treatment of rabies lies not so much in the selection of antagonistic remedies—for those really effective are comparatively few, and their antagonism apparent—as in the quantity and quality of their application, and in the discovery of efficacious rational means of supporting the system, and obviating tendency to death during the limited time which virus requires to eliminate or exhaust itself.

There is, so far as our present knowledge goes, no specific poisonous action in the system which we can chemically neutralize. We can only counteract or moderate its manifestations by exhibition of antagonistic therapeutic agents, and support the patient's strength till the violence of disease abates.

Intelligent and courageous nursing, then, to insure entrance into, and retention in the body of the quantities and qualities of food and drugs recommended, is of as much importance as their prescription, and a duty there is reason to assume, the importance of which has been sometimes undervalued.

As an encouragement to those upon whom the abhorrent task devolves, it may be mentioned that there is hardly any instance on record, if any, of an attendant having been fatally inoculated by a human patient.

It has been mentioned in many recorded cases that nutrition was impracticable to any considerable extent, owing to the production of convulsions by any attempts at deglutition, and the expulsion of enemata, and doubtless in numerous instances the difficulty is great.

Whether, however, a reluctance to active interference, from its assumed hopelessness, has been produced to too great an extent, is a question for subsequent evidence to decide.

The operation of tracheotomy or laryngotomy seems to produce a double effect, relaxing the pharyngeal spasm, while it removes the risk of asphyxia to a considerable degree. It cannot be said to free the patient from all danger of choking, for the tonic contraction of the diaphragm may last long enough to asphyxiate, without any occlusion of the air passages; but this would certainly be unlikely.

In at least one case tracheotomy relaxed a previously severe tendency to pharyngeal spasm, sufficiently to enable the patient to voluntarily swallow cold water, while it markedly decreased the general convulsions, and it rendered easy the use of the stomach pump. But this subject is discussed elsewhere.

In a case treated by M. Menesson, finding chloroform inhalation and hypodermic injections useless, he employed faradization—placing one pole on the neck, and the other on the feet. Immediate relief followed the application of the current, and during the calm interval which succeeded, the patient was enabled to swallow fluids without spasm, and to talk. The case terminated unfavourably, nevertheless, after two days, by cardiac spasm arresting the circulation.

Before considering more approved medicines *seriatim*, a few miscellaneous advices may be interesting.

The Chinese, among other apparently less rational remedies, use cantharides, nux vomica, with cauterization by the moxa, suction, cupping, and poulticing to the wound. To relieve the dysuria caused by cantharides, they prescribe a mixture of yellow earth, liquorice, amber and indigo. Their method of cupping consists of heating a cup by boiling fluid in it, then pressing it over the wound. Quietness is insisted upon.

In the *Medical Journal of America* it is mentioned that Dr. Hartshorne was the first to apply chloroform, in 1848. Dr. Coats and Dr. Jackson were among the earliest to recommend inhalation of ether. Marshall Hall revived tracheotomy. Marochetti's treatment consisted in cauterizing the sublingual lyssæ when found. In Austria it was advised to open the ranine veins and give tonics. Dr. Holland proposed inoculation with variola, reasoning from the absence of variola among dogs, compared with the frequency of rabies. According to Dr. Shinkwin, transfusion was mentioned by Ravelly in 1696, and practised at Eye, in Suffolk, in 1792, with the result that the patient recovered after the blood of two lambs had been exchanged for an equal quantity of his own. Dr. Holland had a high opinion of the procedure, advising, after bloodletting till syncope was induced, the injection of sheep's blood repeatedly.

TRANSFUSION.

We have it on record, that in Suffolk, during 1792, Russel also transfused blood directly from a lamb into the veins of a boy in hydrophobia, with the effect of saving his life, while twenty of the people in the district perished from the disease. The blood was not injected, but directly transfused from the carotid artery in the lamb, to the cephalic vein, by means of two silver canulæ, and an india-rubber tube.

COLD DOUCHE,

as mentioned previously, is a very old treatment. It was formerly applied merely by immersing the patient in the sea or nearest water, and keeping him there till life was almost extinct. Several instances are handed down of recovery following this. Dr. W. J. Moore records at least two cases, both occurring at Joudpoor, in both of which cases the patients lived, and he says that—"Although failures are frequent, and successes rare, yet the contrast of results from this with those following other treatments induces him habitually to pursue it." A successful case he describes is that of a lad aged fourteen, bitten some six weeks previously by a dog undoubtedly rabid. He had, when seen, been suffering for upwards of twelve hours from the usual symptoms, including hydrophobia with secretion of viscid mucus and salivation, and recovered completely. The treatment included cold affusion to head and neck, alternated with administration of chloroform, and vesication over throat and spine by lunar caustic. An European soldier also recovered under his care, having been subjected to a somewhat similar treatment. The particulars are as follows (*Trans. Bombay Med. and Phys. Society*, vol. vi., 1861) :—The patient was a private, aged twenty-one, and when first seen was struggling upon his bed, at intervals of a minute or two, in convulsions involving the whole muscular system, which partook of the nature of emprosthotonos, and opisthotonos. Several persons were engaged in holding him. The pupils acted naturally, conjunctivæ injected slightly, face flushed, pulse full and quick, surface bathed in perspiration, extremities warm, countenance distorted during spasm, intermissions between the latter perfect, and some frothy salivation. He appeared perfectly sensible when addressed, but was unable to articulate distinctly, his efforts at speech resulting only in a hoarse croaking noise. The mouth was easily opened, but during the spasms the lips were forcibly retracted, and the teeth exposed in a ghastly grin, while inspiration and expiration were performed with effort, and accompanied by a hoarse bronchial râle.

The history was, that while at work he had suddenly, without scream or cry, fallen down struggling and choking. A grain and a half of tartar emetic was dissolved in an ounce and a half of water, and brought to the patient, but the sight of the fluid at once produced extreme alarm and renewed convulsions, accompanied by constant hawking, and expectoration of frothy mucus from the mouth, and clutching at the throat, as if to remove some obstruction there. It being impossible to administer the dose by the mouth, on account of the incessant struggling and expectoration, it was given with a spoon through the nose, but appeared to effect no change. The convulsive paroxysms continued with increased violence and frequency, along with hoarse cries, incessant hawking, expectoration and clawing at the throat. On inquiry as to whether there was any history of a bite, his friends stated that he had often spoken of having been bitten by a mad dog, but when the accident happened they could not say. Scars were seen on the thigh, but no inflamed wound.

No doubt remaining as to the nature of the case, Dr.

Moore at once proceeded to apply his treatment, which consisted of cold affusion to the head in the open air, combined with quick vesication over the trachea and larynx. The patient was removed to the verandah, and cold water poured on his head from a height of six feet or so. The first pailful produced frightful spasms; at the second they became less intense, the pulse beginning to sink in force and frequency. Three or four pailfuls reduced the convulsions to a mere trembling, and the circulation to an intermittent state, while the man's condition, as he lay semi-conscious, with tremulous eyelids and sighing respiration, resembled that of recovery from syncope. A stick happening to fall into the bucket of water, the splashing noise was instantly followed by a renewal of spasm, and difficulty in respiration. The cold affusion was repeated with the same result as before, and, while the patient remained quiescent an enema of castor oil and water was administered. Ten drops of croton oil were placed on the back of the tongue with a feather, and nitrate of silver applied freely over the trachea and larynx externally.

The man now (2 P.M.) appearing inclined for sleep was left in quiet till 4, when, finding that spasms were beginning to return, though with less violence, some chloroform was administered, and he remained quiet for an hour.

At 5.30 patient was lying on his side hawking and expectorating as before, but the secretion less. An offer of water renewed the spasm in the throat, but there was very little general convulsion.

At 9 P.M., symptoms increasing, one drachm and a half of chloroform was administered, with application of nitrate of silver to the throat, and one hour afterwards five grains ext. cannabis ind. in two ounces water.

At 12 convulsions had ceased, breathing still bronchial. Throat blistered from nitrate of silver. Repeat cannabis ind. five grains during next two days.

Symptoms steadily decreased, and patient recovered without complications. Throat regaining power last.

This case is interesting, as showing the good effects of cold affusion, and its compatibility with the administration of chloroform.

The water should be poured chiefly upon the back of the head and neck, so as to affect the medulla and upper cord as much as possible, without blanching the anterior cerebrum; and the application should be intermittent, ceasing the moment its effect is produced, so as to avoid unnecessary expenditure of vital force; as prostration is an enemy to be dreaded later on.

Stimulants might be administered with comparative freedom, combined with nutrients during the intervals, if any degree of collapse be present.

A cold stream thus applied intermittently to the back of occiput and neck, is a considerably better method of obtaining the results of cold than general baths, ice-bags or caps, for it reaches the origin of the disease directly, without lowering the general vital force so much as continuous or general cold applications. And it also seems to act beneficially by sudden shock.

It takes advantage of our pathological knowledge of the locality affected by directly decreasing the blood supply of the medulla without interfering with other parts, or with the action of other remedies, which it may be desired to use against the disease. And its force is susceptible of accurate graduation.

Hot Baths

of various kinds, vapour, Turkish, Russian, and plunge have also had advocates, but there is less evidence in their favour. Copious perspiration is undoubtedly a powerful eliminative factor in rabies, and warm baths of all kinds, favour it as well as exerting a certain sedative influence of their own, but there, probably, their good effects end.

To be of any use they must be powerful and prolonged. The most likely to do good would be those in which the patient's body is immersed, and the temperature of the water gradually changed.

During the earliest stages of the disease a strong steam bath could not fail to be of service—perhaps combined with vaporized mercury, as mentioned further on—but Turkish baths, besides being usually unobtainable, would hardly, as generally used, be powerful enough to be of utility proportionate to the loss of time involved.

A French physician, M. Buisson, thought he had discovered a certain cure for rabies in excessive perspiration, induced by warm baths and warm decoction of sarsaparilla. And so convinced was he of the efficacy of the method, that, with a courage worthy of his nation, he is said to have offered to allow himself to be inoculated from a mad dog. No one, however, ventured to hold him to his promise.

According to his account he was inoculated while attending a hydrophobic patient, felt all the symptoms of the disease, constriction of the pharyngeal muscles, &c., and in consequence entered a Russian vapour-bath at a temperature of 107° Fahr., with the object of committing suicide rather than endure the disease.

He intended to gradually raise the temperature till life should be impossible, hoping that in that way syncope would be induced, and a painless death ensue, but to his astonishment he found that his symptoms decreased in inverse ratio to the temperature of the bath, and finally vanished, leaving him recovered from his disease.

Since then he remarks that he has treated eighty cases successfully, but the natural inference of an unbeliever is, of course, that his cases were not true rabies, but hysterical or other forms of hydrophobia.

TRACHEOTOMY.

THE operation of tracheotomy or laryngotomy, though it has not been performed in a successful case, and very seldom in any, seems to promise good results in suitable cases. It owes its revival in great degree to Dr. Marshall Hall.

In a case recorded by Dr. Norman Chevers, in *Indian Med. Annals*, 1865, he says that its performance was followed by distinct relief in the respiration, and freedom from risk of suffocation during spasm. And in addition its effects were felt both in the circulation and powers of deglutition.

The heart's action became regular and stronger (doubtless owing in part to the increased regularity and less frequent interruption in respiration), and the patient (although the spasms brought on by light or sound of fluid continued as before) distinctly regained the power of deglutition, all pharyngeal spasm relaxed, and he swallowed a tablespoonful of nourishment on several occasions, as well as several tablespoonfuls of *cold water* without much effort.

The general paroxysms, however, continued, and the patient died from exhaustion, the heart's action failing.

The operation may be accounted a very considerable safeguard against asphyxia in every case, for though generally the paroxysms completely involve all the respiratory apparatus, and not only the laryngeal muscles, yet the effort is inspiratory, produced by contraction of the diaphragm, and, therefore, it would require a very unusually prolonged convulsion to cause death by asphyxia. The procedure of course affords no protection against death by asthenia, which is the usual termination, but it prepares the way for the use of other remedies antagonistic to that event (for instance, the use of the stomach-pump), as well as acting favourably upon the heart and general circulation, by avoiding the constitutional friction of tremendous paroxysmal efforts. So that, in addition to directly influencing the tendency to asphyxia, laryngotomy indirectly tends to obviate asthenia, the Scylla and Charybdis in hydrophobia. And also it has been shown to exercise an unexpected power over the pharyngeal spasm.

In itself the operation is simple, and unattended with risk sufficient to cause worthy hesitation in such a desperate disease. Of laryngotomy, laryngo-tracheotomy, and tracheotomy, the easiest is the best, but to be effectual it should be done early.

In the case quoted, it was considered that the operation was performed early enough to produce decidedly beneficial effects, but (as spasm of the heart had already set in, and asthenia was far advanced) too late to preserve life.

Dr. Chevers believes that "whenever a case of hydrophobia is seen early, the surgeon is justified in opening the trachea immediately."

In his case it relieved the spasm of the glottis, though general spasm remained. It strengthened the circulation, and enabled the patient to swallow, although not performed till the disease was far advanced, and too late to save life.

The additional treatment he employed in his case consisted of chloroform inhalations occasionally, and morphia, with a little wine and water and spoonfuls of milk.

Conium has been found a valuable antagonistic. Dr. Overend Drury recommends it.

If rabies be, when fully developed, as yet practically almost uncontrollable, we are nevertheless fortunate in possessing a preventive remedy which seldom fails.

CAUTERIZATION.

In cauterization, freely and completely performed immediately or promptly after inoculation, we have an almost absolute safeguard against hydrophobia.

This procedure may in every instance, and ought to in some cases, be supplemented by more or less wide excision of the bitten part.

If the wound be deeply punctured, extensively lacerated, or in such a position that contact of the actual cautery, or a powerful caustic, cannot absolutely be assured to every portion of the injured surface, it becomes the manifest duty of the surgeon to place his patient under an anæsthetic, should that nerve restraint be required, and to remove with the knife all impediments to the free and total destruction of the whole infected surface.

The most remote corner of the wound is that in which the virus is most likely to lodge, and should the smallest particle of it remain, the labour of the surgeon will have been in vain.

In doubtful cases, therefore, it is better to freely excise the bitten part, and apply caustic or a red-hot iron to the bleeding surface, having first encouraged that bleeding to a moderate extent in the hope of its washing the virus away.

When instant surgical help cannot be obtained the patient should at once wind a cord tightly around the limb above the bite, twisting the string till all circulation has been stopped. Then, as Sir T. Watson recommends, a stream of water should be directed upon the spot from a height, so as to completely wash out the wound, and as soon as possible its whole interior surface should be destroyed by the application of a red-hot iron. Afterwards a poultice may be applied to relieve the pain.

In cases where the bite merely consists of a few slight punctures, or scratches made by the longer or more pointed teeth, still greater particularity in cauterization should be observed, for the most minute puncture may contain sufficient venom to inoculate, and is more liable to be overlooked than a larger wound. The point of a knitting-needle, or a similar object, should be inserted at a white heat, and freely wriggled about in each puncture, and every scar or abrasion likewise touched. Iron at a white heat causes much less pain by its contact than when only red-hot, and when heated to a great intensity produces very little pain at all.

Nitrate of silver is too mild an agent.

The fact of minute punctures such as those caused by the sharp-pointed canine teeth being sufficient to inoculate, has given origin to the suggestion, that as a preventative to rabies the canine teeth of all dogs should be extracted, or their points filed. This is manifestly impracticable, and besides would not confer immunity, for the dogs would only require to bite a little harder with their remaining teeth to produce the same result. Also rabies is communicable by other means.

COMPRESSION.

The importance of immediate arrest of the circulation is, it is to be feared, but imperfectly understood among the masses, and to this ignorance many deaths are due. If every individual had sufficient knowledge, instantly upon reception of a bite, or even a lick from a supposed rabid animal, to tie a stout cord tightly above the place, before seeking the surgeon, or even applying other remedies, and then to hold the wound under the pump, the mortality from hydrophobia would decrease.

A few simple directions published by Government, and circulated through the country in a form similar to that employed for protection against the Colorado beetle, would save a few lives every year, and be inexpensive.

Must we wait for this till some great man dies?

In increased knowledge among the people lies the only real preventive, and it is urgently required, observing the spread of the disease.

Inspector-General Balfour mentions authentically, a striking instance of the value of cauterization and excision as a preventative. Eighteen persons were bitten by a rabid dog. The wound of one was excised, and cauterized freely with a blacksmith's iron. Two years afterwards, in October, 1877, this man was still in good health, while *all the other bitten persons* died within three months.

The statistics of Böllinger, in the "Cyclopædia of Medicine," 1875, go to show, that out of ten inoculated and cauterized persons, seven escape, while eight out of ten uncauterized die. Even doubting his accuracy as to numbers, we must admit the strength of his favourable evidence.

Mr. Youatt, the late well-known veterinary surgeon, was bitten four times by certainly rabid dogs, and by means (presumably) of instant and intelligent cauterization completely escaped the disease. His favourable testimony on the point also was given freely, and is strong.

INOCULATION.

Whether inoculation may take place through the unbroken skin, or an unabraded mucous membrane, is still a rather open question. From the analogy of other similar poisons it may be presumed that absorption through the uninjured healthy skin would be unlikely; but to bring the virus of rabies in contact with any mucous membrane, would certainly be a perilous experiment.

Sir W. Gull considers sucking the wound "unattended with risk;" but Sir T. Watson characterizes it as "extremely hazardous," and upon such a point it is well to err upon the safe side.

Dr. Todd Thompson also fears that "grave danger would attend the experiment."

Some snake poisons are not transmissible by mucous membranes, but require direct entrance into the blood through a broken surface.

The evidence is strong, that not only does immediate cauterization and excision confer comparative immunity, but that, even after the lapse of considerable time, it still either removes the virus, or tends to lessen the severity of the disease.

EXCISION.

It is assuredly never too late to make the experiment, if the early precaution has been omitted. In Professor

Rust's case, where excision was performed thirty-one days after inoculation, and when symptoms had already evolved, the patient recovered.

In speaking of cauterization, Sir W. Gull asserts that years may elapse between bite and symptoms, and suggests that as the probability is that, in many instances, the venom remains a long time in the matrix of the wound without pervading the system, in cauterization and excision we hold the remedy in our hands.

Morgagni also mentioned cases in which evidence favoured the likelihood of an incubation of many years. Many reasons support the hypothesis, that frequently, and indeed in protracted cases usually, the virus remains localized, imbedded in the matrix of the wound, awaiting some special systemic condition to cause its generalization, and therefore within reach of the knife or cautery. This assumption would explain, otherwise than by mere reflex action, the good results obtained by Dr. Stokes, of Dublin, by constriction of the bitten limb in a tourniquet, and the division of the nerve leading from the inoculated spot in another case.

Certainly, wherever a preliminary aura is felt, prompt and decided local treatment, even extending possibly to amputation, is indicated.

LOCALIZATION.

That the virus remains for a longer or shorter period localised in the wound, is supported by the following considerations:—

I.

The extremely uncertain and irregular period of incubation, contrasted with regularity and comparative uniformity of the symptoms when they do evolve;

II.

The violence and rapidity of symptoms, contrasted with the chronicity of their incubation; and,

III.

The fact that every incubative disease incubates, to a certain extent, regularly. All these combine to form the greatest contradiction and strangest anomaly known to medical science in the case of rabies, unless explained by the hypothesis of non-instantaneous absorption of poison.

THE MERCURIAL VAPOUR-BATH

Recommends itself as a rational treatment, and we have records, more or less authentic, of its success.

The poison of rabies possesses a special affinity for the salivary glands, and it seems a reasonable assumption that their ducts afford a natural channel for its elimination. Taking this view, free salivation, combined with diaphoresis, should assist the natural efforts; and this object fumigation by mercury and steam effects rapidly and fully.

We have considerable evidence in its favour; among which may be mentioned Dr. Wyllie's case at Ahmednuggur, where it apparently effected a cure. The mode of application was as follows :—

The patient was placed upon a cane-bottomed chair, nude; a pan of live charcoal laid underneath; and all enveloped in blankets, leaving the boy's head free. Mercury was now thrown upon the charcoal. In a quarter of an hour saliva poured from the mouth, and rigidity ceased. He lived, and it is asserted that many other persons were cured by the same method during the epizöotic of rabies in India. This would certainly seem a valuable adjunct to other treatment.

Another successful case, treated upon a similar plan, is recounted from Hooshiapore, under the care of Mr. Barnes. In this the patient, suffering from violent and frequent paroxysms, was tied upon a cane-bottomed chair, and surrounded with blankets, leaving the head free. A vessel of boiling water was placed under him, and a mixture of equal parts of mercury and sulphur, well rubbed together, was put in a broken piece of earthenware over a charcoal fire, and laid beside the vessel of boiling water. Fifteen grains of calomel were given at once, and five grains every hour, the mercurial vapour-bath being kept up till the symptoms subsided. In about four hours the man was perfectly calm, and after a course of tonics, gargles to remove salivation, and nourishing food, he was discharged cured.

Dr. G. M. McReddie has also treated cases on this plan, and advises the repetition of the dose at intervals if necessary. The apparatus required is very simple: A cane-bottomed chair, on which the patient sits enveloped in blankets up to the neck. Underneath the chair, any apparatus capable of producing steam and volatilizing calomel; for instance, a spirit-lamp protected in a cage, upon the top of which is a receptacle for the calomel (twenty or thirty grains), and a saucer for water, arranged in such a manner that the flame beneath simultaneously boils the water, and volatilizes the calomel. A Langston Parker's lamp (Savigny) has been advised for the purpose.

CHLORAL ACONITE.

In two cases—both fatal—in the London Hospital, under care of Dr. Fenwick, in 1877, hydrate of chloral gave distinct relief, and exerted a manifest antagonism to the disease, after morphia, chloroform inhalation, venesection, and ice to the spine had been tried.

Aconite lessened somewhat the congestion which formed a prominent symptom in one case, and which venesection to six ounces had previously failed to subdue. It was given in three doses of one-sixtieth of a grain hypodermically, at two hours' interval. The chloral hydrate was administered by enema, twenty or thirty grains occasionally; but was stopped on account of the patient becoming delirious.

Dr. W. P. Mears, who reported the case, considered that chloral has a marked, and possibly great influence over the disease. There is no doubt that it moderates paroxysmal symptoms to a large extent, and would presumably effect a cure if vital force could be supported, and sufficiently protected from its depressent influence.

Dr. Sanson had a case in which he prolonged life to the tenth day by this drug, the patient then dying apparently from causes not directly connected with rabies.

In the two cases mentioned above, death occurred from sudden paralysis, or spasm of the muscles of respiration. The breathing became slow, and quickly stopped, the veins filled, and cutaneous congestion deepened to lividity.

There was no sign of closure of the larynx, nor any indication for tracheotomy in the opinion of the attendants; but it should be recollected that in the cases in which that operation was performed it exerted a secondary and unexpected influence, apparently reflex, and decidedly favourable. Salicine has been mentioned as an eliminative.

Hydrate of Chloral has a decided influence in checking or moderating the paroxysms, and may be used in conjunction or alternation with other modes of treatment

In severe cases, it seems hardly to possess a sufficiently powerful special effect upon the medulla to be of service, without being administered in such large doses as injuriously to influence the heart, and sensorium. It is, however, a remedy clearly antagonistic to the manifestations of rabies.

It should be injected hypodermically in frequent doses.

NERVE TRACTION.

Dr. Bowman, of Manchester, recognizing the analogy between tetanus and hydrophobia, suggested that the treatment successfully carried out by Professor Vogt in traumatic tetanus, should be applied to hydrophobia.

In the case referred to, the brachial plexus was exposed, and the nerve trunks drawn out and stretched, with the result that all tetanic symptoms ceased, and the patient recovered. This treatment might possibly be advantageous in a case where the premonitory aura has been felt in an extremity, if the surgeon be called in sufficiently early.

In cases where preliminary aura is felt, *Neurotomy* has been recommended on the same principle as Nerve Traction. Amputation of the limb has also been advised, and constriction by tourniquet has been practised with decided advantage by Dr. Stokes, of Dublin.

CHLOROFORM INHALATION

Is of universal value in rabies, and should form part of the treatment in almost every case. It should be economized and superseded by milder modes so far as possible, however, as its effects are too transient and depressent. It may be combined, or alternated with chloral hydrate treatment.

Ether, as less depressent, should be preferable to chloroform, but on some constitutions does not act so well.

In a case under the care of Mr. S. Jones, mentioned in the *Lancet*, October 23, 1875, the patient, a man admitted 3 P.M., died next morning at 7.20. Here, although the result was adverse, chloroform gave marked relief and greatly moderated the paroxysms. There is no mention of any nourishment or stimulant having been administered, except a nutrient enema, and half an ounce of brandy, and he seems to have died of asthenia.

Marochetti asserts that lyssæ appear in the form of clusters of little vesicles at orifices of salivary glands at an uncertain period after reception of bite, and that their cauterization when they appear cures the disease; but it seems obviously contrary to reason that it should have any effect, even should such vesicles appear, for, to produce them, the virus must have permeated the system.

CURARA.

CURARA, urari, or woorali, is a deadly vegetable poison, the exact botanical nature of which is not fully known. According to Schomburgk it is composed of vegetable matter only, and consists chiefly of an extract from the bark of Strychnos toxifera, in Guiana.

According to Waterton and Taylor the Indian natives of Demerara and Essequibo make it of the extracted juice of the woorali vine, mixed with a bitter root, strong Indian pepper, powdered fangs of snakes, and two unknown kinds of bulbous plants, and use it for poisoning their arrow-tips.

It is, at any rate, the extracted juice of a plant, mixed with probably inert extraneous matter and solidified.

Its active principle, Curarine, has a great affinity for water, and is therefore absorbed very rapidly through a wound, symptoms appearing in less than two minutes. Its action is sedative and narcotic, causing in poisonous doses a paralytic and soporific train of symptoms, and an apparently painless death. It is said, like some snake poisons, to be almost inert when swallowed, and the flesh of animals poisoned by it can be eaten. It retains its activity indefinitely if kept dry. It paralyses motor nerves, and has thus an antagonistic action to strychnine, though strangely enough it answers to several tests for that drug; for instance, it turns purple with nitric acid, blue with sulphuric, and violet with dichromate of potassium, and it has a bitter taste. Animals poisoned by it may be kept alive for a considerable time by artificial respiration.

Considering its activity great caution must be exercised both in administering curara and watching its effects. The medical attendant should take particular care to avoid wounding himself with the needle of his syringe, and the instrument should not be used for any other purpose during the illness.

Curara seems to be our nearest approach to a specific against, and the most reliable and direct special antagonist to, rabies that we possess at present. All alleged specifics have failed, but there is solid ground for hope that a system of rational treatment will eventually succeed in a considerable number of instances.

It is encouraging to note, that the duration of rabies has been distinctly influenced by the remedies used, and the patient's life prolonged sometimes to twice the ordinary duration of the disease. In several authentic instances rational treatment seems really to have effected a cure.

Dr. Offenberg, in 1874, treated a female aged twenty-four, who suffered from characteristic symptoms of rabies (eighty days after the imperfectly cauterized bite of a rabid dog), with curara, in doses of one-third of a grain ($\frac{1}{3}$ gr.) every fifteen or more minutes, each dose being administered so soon as the effects of the last began to wear off.

The hydrophobic spasms ceased, and were replaced ultimately by a general paralysis, so complete as to render necessary artificial respiration for some time. During the next few days a mixed series of symptoms ensued, consisting of slight spasms mingled with paralysis, apparently the result of the curara poisoning opposing the disease, but these gradually diminished, and the patient was well on the eighth day.

The chief point noteworthy in this case is the large doses of curara prescribed.

Niemeyer used curara several times, but in considerably smaller doses, and without much good effect.

Messrs. Gale and Co. have made a preparation, of which every five minims contain half a grain of curara. This would be a rather large dose to begin with, but two or three minims might be injected subcutaneously every fifteen minutes till effect produced.

Messrs. Savory and Moore also prepare gelatine discs for subcutaneous injection, each containing a dose.

In addition to Dr. Offenberg's, several successful cases are on record in which curara has been used.

In *Le Paris Médicale,* May 17, 1877, an instance is mentioned under the care of Dr. Polli, in which a child, twelve years old, developed symptoms of rabies eighty days after having been bitten by a rabid dog. After chloroform inhalations, and morphia subcutaneously had been ineffectually tried, curara was injected subcutaneously seven times during five and a half hours, the total quantity used during that time being three grains, or twenty centigrammes. The hydrophobic paroxysms rapidly yielded, and were replaced by a train of paralytic symptoms, evidencing the usual physiological action of the drug. Two days subsequently renewed hydrophobic symptoms were completely banished by another injection of nearly half a grain, or three centigrammes, of curara, a tremendous dose for an exhausted child of twelve. The patient slowly recovered.

Dr. Watson, of Jersey, records another successful case treated with curara, and here we have additional evidence of the true nature of the disease, from the fact that the servant girl of the patient was bitten by the same dog at the same time, and died of unmistakeable rabies a week before her master's illness began. In this case the symptoms gradually increased in severity in defiance of treatment until the exhibition subcutaneously of curara in rapidly-increasing doses, $\frac{1}{16}$, $\frac{1}{9}$, $\frac{1}{6}$ grain every third hour, when they subsided after the third dose, and the patient recovered. Upon the whole, evidence seems to show that at present—

1. Curara is about the most direct antagonist to rabies we possess.

2. Rabid patients will bear larger doses than healthy persons.

3. Subcutaneously it acts best.

4. It must be exhibited cautiously, but in gradually increasing doses, and decreasing intervals, till its effects are fairly evident, for instance, $\frac{1}{16}$ grain every fifteen minutes for an adult till effect produced.

5. It affords protection against asphyxia, but not against asthenia, the latter of which it rather tends to promote.

6. Nutrients and stimulants are more urgently needed when this drug is used.

7. If symptoms of impending paralysis of heart or diaphragm supervene, it should at once be discontinued and replaced by powerful stimuli.

OXYGEN.

The inhalation of Oxygen is said to have been followed by recovery in one or two cases lately.

PREVENTIVE MEASURES.

As the spontaneity of the disease is in man totally denied, and in the lower animals certainly very rare, if not impossible, it is evident that the spread of rabies ought to be preventible by proper legislative measures. In theory so it is, but in practice the work is one of immense difficulty, for in addition to other obstructions, the amount of vexatious interference with the liberty of the subject necessary for effective and complete operation of any stringent regulations appertaining to the ownership and management of dogs, would render the measures unpopular and cause them to be evaded when possible.

The density of popular ignorance upon the subject again intervenes, and renders the masses unwilling to tolerate inconvenient reforms, while without the cordial co-operation of the majority—to bring into action sweeping measures affecting private property of such an universal character as dogs, is an extremely serious undertaking, and one demanding grave cause for its origin. To speak, therefore, of establishing an universal quarantine for a certain time, is to mention a practical impossibility under existing circumstances. To be in the slightest degree effectual, it must be unexceptionably complete, while the vastness and complexity of the social machinery necessary to effect that purpose would place the event in the same category as regards importance as a threatened revolution. The only real and practicable preventive, capable of immediate application, consists in the diffusion among the masses of a certain amount of knowledge of the disease, its preventive treatment, its causes, symptoms, and nature. Rendered by that knowledge more alive to their danger, a more intelligent appreciation of any future legislative efforts on their behalf may be anticipated from the people, and greater caution would be exercised in the management and treatment of dogs.

Especially we might expect from such diffusion of information a decrease in the numbers of domestic pet dogs among the peasantry, who are unaware of their possible future danger, and are more likely to suffer from an outbreak of rabies than the inhabitants of a higher grade in society, from the greater intimacy and companionship which exist between the dogs and their owners.

A few simple measures, however, are feasible at once, and would exert a certain amount of power.

I.

Printed directions and advice how to act when bitten by a supposed rabid animal, with description of the usual symptoms of the disease in the dog, might at a trifling expense be published by Government, and posted up in the form of a placard at each police station throughout the United Kingdom.

This would save a few lives every year.

II.

The existing dog laws should be strictly enforced, and the highest penalties permissible exacted by magistrates for their infringement.

III.

As soon as possible the metropolitan laws should be made applicable to the provinces, or the provincial laws made more stringent.

IV.

All stray dogs should be destroyed instantly, unless